

## ABSTRACT

A reversible electrochemical system adapted to operate between a fuel cell mode, an electrolysis mode, and a mode alternating between electrolysis mode and fuel cell mode, also referred to as an energy storage mode, operating on a fuel gas mixture and an oxygen-containing gas mixture. While in the fuel cell mode, a current of electrons are delivered to an oxygen electrode where their charge is transferred to a plurality of oxygen ions and the oxygen ions are passed through an electrolyte to a fuel electrode where the charge is transferred back to the electrode. While in the electrolysis mode, a current of electrons are sent to a fuel electrode where the charge is transferred to a plurality of oxygen ions that are formed by the decomposition of steam, and the oxygen ions are passed through an electrolyte to an oxygen electrode where the charge is transferred back to the electrons. While in the energy storage mode, the system alternates between the electrolysis mode and the fuel cell mode.